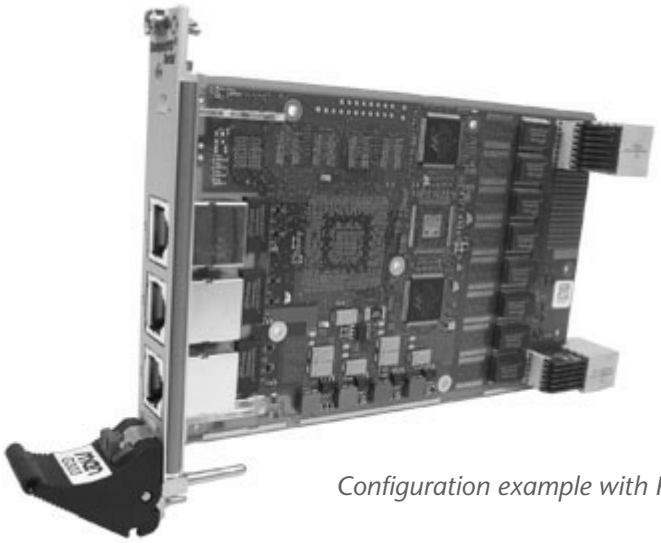
Embedded Solutions

G303 – 3U CompactPCI® Serial Unmanaged 16-Port Gb ETH Switch



Configuration example with RJ45 connectors

User Manual

mikro elektronik
gmbh · nürnberg

G303 – 3U CompactPCI® Serial Unmanaged 16-Port Gb ETH Switch

The G303 is an unmanaged 3U Ethernet switch implemented as a CompactPCI® Serial board. It occupies one peripheral slot, using a 4 HP front panel with 3 Gigabit Ethernet ports on RJ45 or M12 connectors. The G303 either features three Ethernet ports on the front and up to 13 Ethernet ports on the rear or alternatively all 16 Ethernet ports on the rear, which is the ideal solution for conduction cooling.

The G303 supports full-duplex and half-duplex operation with auto-negotiation, high-speed non-blocking store-and-forward switching, Quality of Service (QoS) support with four traffic classes IEEE 802.1p. Its built-in test mechanisms make the G303 an even more reliable component in the communication system.

By using an application-specific configuration EEPROM, the G303 can act similarly to a managed switch with fixed settings. This enables features untypical for unmanaged models like 802.1p priority and port-based priority, port-based VLAN or IEEE 802.1q VLAN IDs.

The board is specifically designed for rugged mobile communication systems and fully compliant with the EN 50155 railway standard, qualified for a -40 to +85°C operation temperature and ready for coating.

Technical Data

Switch Fabric Key Features

- Three 10/100/1000Base-T ports at front panel and up to 13 ports on rear or up to 16 10/100/1000Base-T ports on rear
  - Electrical isolation: 1500 Vrms on front ports and 100 Vrms on rear ports
- Auto-negotiation
- High-speed non-blocking, store-and-forward switching
- 8K MAC address lookup table with automatic learning and aging
- QoS (Quality of Service) support with 4 traffic classes (IEEE 802.1p tagged frames)
- Layer 2 switching
- Energy Efficient Ethernet IEEE802.3az
- Back pressure or IEEE802.3x flow control
- Automatic MDI/MDI-X crossover (all ports)

Supported Ethernet Standards

- Transparent bridging: IEEE 802.1d, 2004
- VLAN: IEEE 802.1q Rev D5.0, 2005
- Port-based VLANs: IEEE 802.1q Rev D5.0, 2005
- Link aggregation: IEEE 802.3ad, 2005
- Priority-based switching: IEEE 802.1p

Front I/O

- Three Ethernet ports on RJ45 or M12 connectors
- Six link and activity Ethernet status LEDs (2 per channel)

Rear I/O

- Up to 16 Ethernet links

CompactPCI® Serial

- Compliance with CompactPCI® Serial PICMG CPCI-S.0 Specification
- System or Peripheral slot

Electrical Specifications

- Supply voltage/power consumption
  - +12 V (+/-10%), approx. 13 W max.

Mechanical Specifications

- Dimensions: conforming to CompactPCI® Serial specification for 3U boards
- Front panel: 4HP with ejector
- Weight: 156 g (with RJ45 connectors)/tbd g (with M12 connectors)

Environmental Specifications

- Temperature range (operation):
  - -40..+85°C (qualified)
  - Airflow: 1.0 m/s
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to +3000 m
- Climatic tests according to EN 68068
- Shock and vibration tested according to EN 61373
- Conformal coating on request

MTBF

- 887 894 h @ 40°C according to IEC/TR 62380 (RDF 2000)

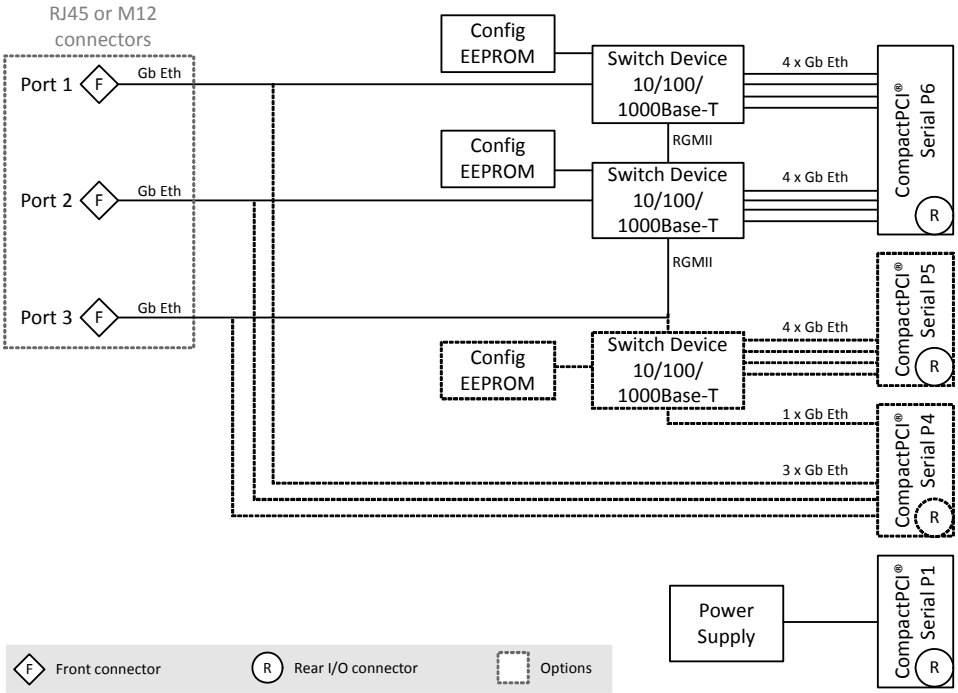
Safety

- PCB manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Tested according to EN 55022 (radio disturbance), IEC1000-4-2 (ESD) and IEC1000-4-4 (burst)

Block Diagram



Configuration Options

Ethernet Switch

- Managed version G302

Front Connectors

- RJ45 connectors or M12 connectors

Front I/O, Rear I/O

- Flexible combination of front and rear ports
  - Three ports on front and up to 13 ports on rear
  - Up to 16 ports on rear (suitable for conduction cooled version)

Environmental specifications

- Conformal coating

Cooling Concept

- Also available with conduction cooling in MEN CCA frame

Please note that some of these options may only be available for large volumes. Please ask our sales staff for more information.

For available standard configurations see online data sheet.

Product Safety

Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

It describes the hardware functions of the board, connection of peripheral devices and integration into a system. It also provides additional information for special applications and configurations of the board.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2012-12-18

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This sign marks important notes or warnings concerning the use of voltages which can lead to serious damage to your health and also cause damage or destruction of the component.

This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics — Folder, file and function names are printed in *italics*.

bold — **Bold** type is used for emphasis.

`monospace` — A `monospaced` font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

comment — Comments embedded into coding examples are shown in green color.

hyperlink — Hyperlinks are printed in blue color.

The globe will show you where hyperlinks lead directly to the Internet, so you can look for the latest information online.

IRQ#
/IRQ — Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out — Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".

Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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The WEEE directive does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company which puts the product on the market, as defined in the directive; components and sub-assemblies are not subject to product compliance.

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1 Getting Started

This chapter gives an overview of the board and some hints for first installation in a system.

1.1 Map of the Board

Two types of front panels are available, either with three RJ45 Ethernet connectors or with three M12 Ethernet connectors.

Figure 1. *Map of the board – front panels with RJ45 ports (left) or M12 ports (right)*

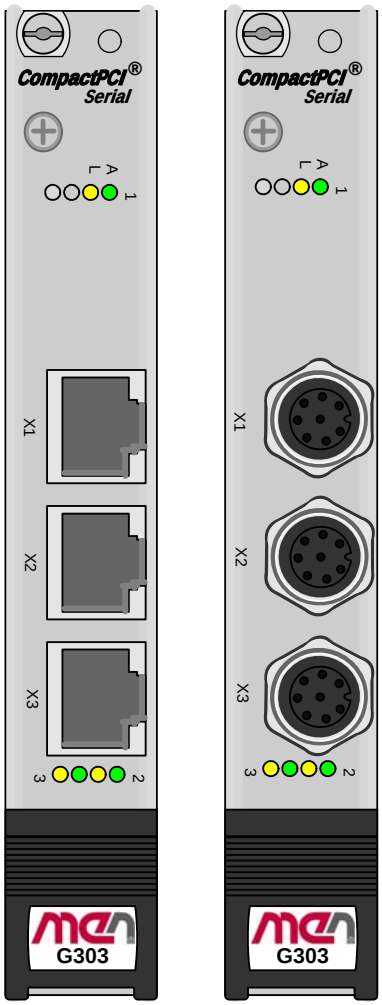
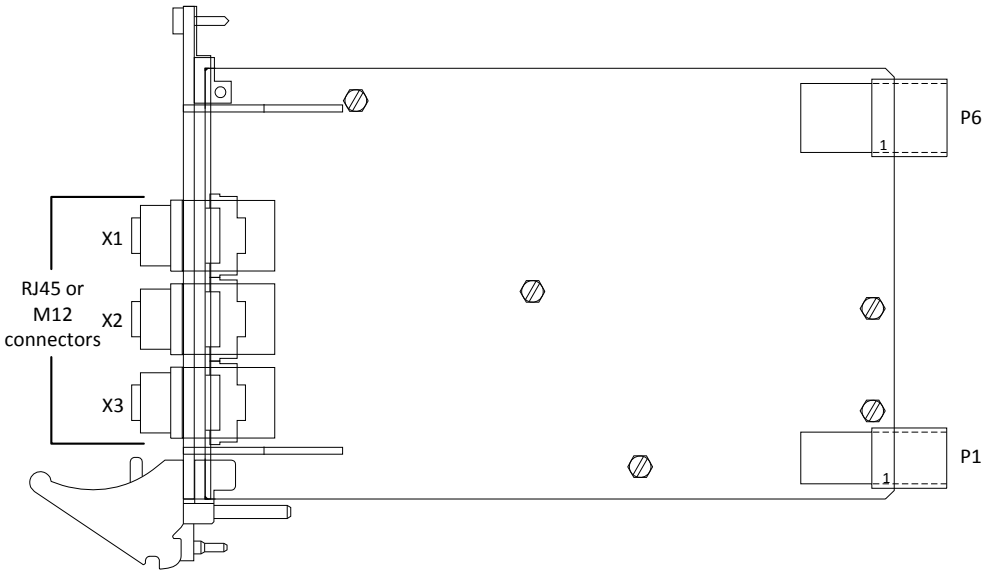


Figure 2. *Map of the board – top view*



1.2 Integrating the Board into a System

You can use the following check list when installing the board in a system for the first time and with minimum configuration.

System Slot

The G303 can act as the switching hub of a CompactPCI Serial system when inserting it into the system slot.

☑ Power down the system.

☑ Insert the G303 into the system slot of your CompactPCI Serial system, making sure that the CompactPCI Serial connectors are properly aligned.

Note:Note: The system slot of every CompactPCI Serial system is marked by a triangle △ on the backplane and/or at the front panel. It also has red guide rails.

☑ Power up the system.

Peripheral Slot

☑ Power down the system.

☑ Insert the G303 into a peripheral slot of your CompactPCI Serial system, making sure that the CompactPCI Serial connectors are properly aligned.

Note: The peripheral slots of every CompactPCI Serial system are marked by a circle with a plus sign behind it ⌖ on the backplane and/or at the front panel.

☑ Power up the system.

1.3 Installing Driver Software

For a detailed description on how to install driver software please refer to the respective documentation.

You can find any driver software available for download in the G303 pages on MEN's website.

2 Functional Description

2.1 Power Supply

The G303 is supplied with +12V (-10%/+10%) via CompactPCI Serial connector P1.

2.2 Thermal Considerations

A suitable heat sink is provided to meet thermal requirements.

Please note that if you use any other heat sink than that supplied by MEN, or no heat sink at all, warranty on functionality and reliability of the G303 may cease. If you have any questions or problems regarding thermal behavior, please contact MEN.

2.3 Ethernet Interface

Depending on the configuration the G303 has up to 16 Gigabit Ethernet interfaces. It is either possible to have three Ethernet interfaces at the front and up to 13 Ethernet interfaces on the rear or to have up to 16 Ethernet interfaces on the rear. The G303 standard model provides three Ethernet ports on the front and eight on the rear. All channels support 10/100/1000Base-T physical layers, and half-duplex and full-duplex operation complying with IEEE802.3x.

The unique MAC addresses are set at the factory and should not be changed. Any attempt to change these addresses may create node or bus contention and thereby render the board inoperable.

2.3.1 Front-Panel Connection

The G303 is available in two versions: one provides three standard RJ45 connectors (standard version) and one three 8-pin M12 connectors at the front panel.

The pin assignments correspond to the Ethernet specification IEEE802.3

Table 1. *Signal mnemonics of Ethernet front-panel connectors*

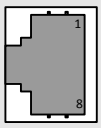
Signal	Direction	Function
BI_Dx+/-	in/out	Differential pairs of data lines for 1000Base-T

RJ45 Connectors

Connector types:

- Modular 8/8-pin mounting jack according to FCC68
- Mating connector:
  Modular 8/8-pin plug according to FCC68

Table 2. *Pin assignment of RJ45 Ethernet front-panel connectors*

		1000Base-T
	1	BI_DA+
	2	BI_DA-
	3	BI_DB+
	4	BI_DC+
	5	BI_DC-
	6	BI_DB-
	7	BI_DD+
	8	BI_DD-

M12 Connectors

Connector types:

- 8-pin M12 receptacle A-coded 90°
- Mating connector:
  8-pin M12 plug A-coded 90°

Table 3. *Pin assignment of M12 Ethernet front-panel connectors*

		1000Base-T
	1	BI_DC-
	2	BI_DD+
	3	BI_DD-
	4	BI_DA-
	5	BI_DB+
	6	BI_DA+
	7	BI_DC+
	8	BI_DB-

2.3.2 Front Panel Status LEDs

The front panel features two LEDs for each of the three Ethernet ports to display their status (*LNK* and *ACT*). The LEDs act as described in the following table.

Table 4. *Ethernet ports status LEDs*

LED	Description
L	Ethernet link status (on = link established)
A	Ethernet traffic activity status (blink = Ethernet traffic running)

2.3.3 Ethernet Switch

The G303 uses two 7-port 10/100/1000Base-T switch components Marvell 88E6176. The switch provides 10/100/1000 Mbits/s configuration possibility on each port. It is possible to configure each port in half-duplex or full-duplex mode.

The device characteristics are:

- Three front ports and up to 13 ports on the rear or up to 16 ports on the rear
- RGMII interface
- High-speed non-blocking
- Store-and-forward switching
- Auto-negotiation
- Quality of Service (QoS) support
- Port monitoring
- Flow control
- VLAN support
- Automatic MDI/MDI-X crossover (all ports)
- Port-based frame priorization

2.3.4 Configuration of the Switch

The G303 loads the following standard configuration at startup:

Table 5. *Default switch configuration at startup*

Setting	Default
Duplex mode	Full Duplex
Port speed	Auto-Negotiate
VLAN (port-based)	Off
QoS (Quality of Service)	Off
Port monitoring	Off
Port trunking	Off

By using a customer-specific configuration EEPROM, the G303 can act similarly to a managed switch with fixed settings. Please contact MEN's sales team if you need a switch with a non-standard configuration.

2.4 CompactPCI Serial Interface

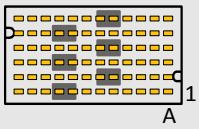
The G303 uses the rear connectors P1 and P6 according to the CompactPCI Serial specification (PICMG CPCI-S.0). Optionally the G303 can be supplied with connector P5 if up to 15 Ethernet ports are required or with connectors P5 and P4 if 16 Ethernet ports are required or if more than 12 ports are required on the rear.

Pin Assignment of Connector P1

Connector type of P1:

- 72-pin Airmax VS 4 pair, right angle header, 6 IMLA with end walls

Table 6. *Pin assignment of CompactPCI Serial P1 connector*



PE_ Rx03-	PE_ Rx03+	GND	PE_ Tx03-	PE_ Tx03+	GND	PE_ Rx02-	PE_ Rx02+	GND	PE_ Tx02-	PE_ Tx02+	GND	6
GND	PE_ Rx01-	PE_ Rx01+	GND	PE_ Tx01-	PE_ Tx01+	GND	PE_ Rx00-	PE_ Rx00+	GND	PE_ Tx00-	PE_ Tx00+	5
1_SATA_ Rx-	1_SATA_ Rx+	GND	1_SATA_ Tx-	1_SATA _Tx+	GND	PE_ REFCLK-	PE_ REFCLK+	GND	1_USB2-	1_USB2 +	GND	4
GA3	SATA_S L	SATA_ SCL	GA2	SATA_S DO	SATA_ SDI	GA1	1_USB3_ Rx-	1_USB3_ Rx+	GA0	1_USB3 _Tx-	1_USB3 _Tx+	3
SYSEN#	PCIE_ EN#	GND	PE_ WAKE#	RST_ IN#	GND	RST_ OUT#	PS_ON#	GND	IPMB_S DA	IPMB_ SCL	GND	2
GND	+12V	+12V	GND	+12V	+12V	GND	+12V	+12V	GND	STNDBY	+12V	1
L	K	J	I	H	G	F	E	D	C	B	A	

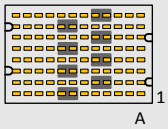
Note: The signals in gray font are specified in the CompactPCI Serial specification but not supported on this board.

Pin Assignment of Connector P6

Connector type of P6:

96-pin Airmax VS 4 pair, right angle header, 8 rows, 4 walls

Table 7. *Pin assignment of CompactPCI Serial P6 connector*



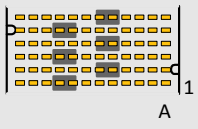
8_ETH_ D-	8_ETH_ D+	GND	8_ETH_ C-	8_ETH_ C+	GND	8_ETH_ B-	8_ETH_ B+	GND	8_ETH_ A-	8_ETH_ A+	GND	8
GND	7_ETH_ D-	7_ETH_ D+	GND	7_ETH_ C-	7_ETH_ C+	GND	7_ETH_ B-	7_ETH_ B+	GND	7_ETH_ A-	7_ETH_ A+	7
6_ETH_ D-	6_ETH_ D+	GND	6_ETH_ C-	6_ETH_ C+	GND	6_ETH_ B-	6_ETH_ B+	GND	6_ETH_ A-	6_ETH_ A+	GND	6
GND	5_ETH_ D-	5_ETH_ D+	GND	5_ETH_ C-	5_ETH_ C+	GND	5_ETH_ B-	5_ETH_ B+	GND	5_ETH_ A-	5_ETH_ A+	5
4_ETH_ D-	4_ETH_ D+	GND	4_ETH_ C-	4_ETH_ C+	GND	4_ETH_ B-	4_ETH_ B+	GND	4_ETH_ A-	4_ETH_ A+	GND	4
GND	3_ETH_ D-	3_ETH_ D+	GND	3_ETH_ C-	3_ETH_ C+	GND	3_ETH_ B-	3_ETH_ B+	GND	3_ETH_ A-	3_ETH_ A+	3
2_ETH_ D-	2_ETH_ D+	GND	2_ETH_ C-	2_ETH_ C+	GND	2_ETH_ B-	2_ETH_ B+	GND	2_ETH_ A-	2_ETH_ A+	GND	2
GND	1_ETH_ D-	1_ETH_ D+	GND	1_ETH_ C-	1_ETH_ C+	GND	1_ETH_ B-	1_ETH_ B+	GND	1_ETH_ A-	1_ETH_ A+	1
L	K	J	I	H	G	F	E	D	C	B	A	

Pin Assignment of Connector P5

Connector type of P5:

96-pin Airmax VS 4 pair, right angle header, 6 rows, 2 walls

Table 8. *Pin assignment of CompactPCI Serial P5 connector*



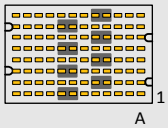
9_ETH_ D-	9_ETH_ D+	GND	9_ETH_ C-	9_ETH_ C+	GND	9_ETH_ B-	9_ETH_ B+	GND	9_ETH_ A-	9_ETH_ A+	GND	6
GND	10_ETH_ D-	10_ETH_ D+	GND	10_ETH_ C-	10_ETH_ C+	GND	10_ETH_ B-	10_ETH_ B+	GND	10_ETH_ A-	10_ETH_ A+	5
11_ETH_ D-	11_ETH_ D+	GND	11_ETH_ C-	11_ETH_ C+	GND	11_ETH_ B-	11_ETH_ B+	GND	11_ETH_ A-	11_ETH_ A+	GND	4
GND	12_ETH_ D-	12_ETH_ D+	GND	12_ETH_ C-	12_ETH_ C+	GND	12_ETH_ B-	12_ETH_ B+	GND	12_ETH_ A-	12_ETH_ A+	3
-	-	GND	-	-	GND	-	-	GND	-	-	GND	2
GND	GPIO2	+3.3V	GND	I2C_SCL	I2C_SDA	GND	COM_RX	COM_TX	GND	+3.3V	GPIO1	1
L	K	J	I	H	G	F	E	D	C	B	A	

Pin Assignment of Connector P4

Connector type of P4:

96-pin Airmax VS 4 pair, right angle header, 8 rows, 4 walls

Table 9. *Pin assignment of CompactPCI Serial P4 connector*



13_ETH_ D-	13_ETH_ D+	GND	13_ETH_ C-	13_ETH_ C+	GND	13_ETH_ B-	13_ETH_ B+	GND	13_ETH_ A-	13_ETH_ A+	GND	8
GND	14_ETH_ D-	14_ETH_ D+	GND	14_ETH_ C-	14_ETH_ C+	GND	14_ETH_ B-	14_ETH_ B+	GND	14_ETH_ A-	14_ETH_ A+	7
15_ETH_ D-	15_ETH_ D+	GND	15_ETH_ C-	15_ETH_ C+	GND	15_ETH_ B-	15_ETH_ B+	GND	15_ETH_ A-	15_ETH_ A+	GND	6
GND	16_ETH_ D-	16_ETH_ D+	GND	16_ETH_ C-	16_ETH_ C+	GND	16_ETH_ B-	16_ETH_ B+	GND	16_ETH_ A-	16_ETH_ A+	5
-	-	GND	-	-	GND	-	-	GND	-	-	GND	4
GND	-	-	GND	-	-	GND	-	-	GND	-	-	3
-	-	GND	-	-	GND	-	-	GND	-	-	GND	2
GND	-	-	GND	-	-	GND	-	-	GND	-	-	1
L	K	J	I	H	G	F	E	D	C	B	A	

3 Appendix

3.1 Literature and Web Resources

- G303 data sheet with up-to-date information and documentation:
  www.men.de/products/02G303-.html

3.1.1 Ethernet

- ANSI/IEEE 802.3-1996, Information Technology - Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications; 1996; IEEE
  www.ieee.org
- Charles Spurgeon's Ethernet Web Site
  Extensive information about Ethernet (IEEE 802.3) local area network (LAN) technology.
  www.ethermanage.com/ethernet/
- InterOperability Laboratory, University of New Hampshire
  This page covers general Ethernet technology.
  www.iol.unh.edu/services/testing/ethernet/training/

3.1.2 CompactPCI Serial

- CompactPCI Serial Specification PICMG CPCI-S.0 Revision 1.0: 2011; PCI Industrial Computers Manufacturers Group (PICMG)
  www.picmg.org
- Introduction to CompactPCI Serial on Wikipedia:
  en.wikipedia.org/wiki/CompactPCI_Serial

3.2 Finding out the Product's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or design revisions of the G303. You can find information on the article number, the design revision and the serial number on two labels attached to the board.

- **Article number:** Gives the product's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the design revision of the product.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 3. *Labels giving the product's article number, revision and serial number*